Remarks/Arguments:

Claims 1, 2, 4-15, and 18-30 are pending. All pending claims are rejected.

The present invention is directed towards a display including electroluminescence (EL) elements disposed between a plurality of cathode wires and anode wires. An anode control circuit is connected between the anode wires and a current source for discharging stored charge in the EL elements and controlling current flow into the anode wires. A cathode control circuit is connected between the cathode wires and a voltage source for discharging stored charge from the EL elements and controlling voltage at the cathode wires. A display controller controls the anode control circuit and the cathode control circuit to set a discharge time for discharging the EL elements before light emission of the EL elements to improve luminance characteristics of the display device.

Claims 1, 2, 4-15, and 18-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,978,403 to Iwasa et al. (herein Iwasa) in view of U.S. Patent No. 6,333,599 to Kawanami et al. (herein Kawanami) and U.S. Patent No. 6,195,075 to Shino et al. (herein Shino). It is respectfully submitted, however, that the claims are patentable over the art of record for the reasons set forth below.

Iwasa discloses a display device having a two dimensional array including elements arranged in two dimensions in an elongated region that is longer in the horizontal direction than in the vertical direction. The device array includes N elements arranged in the horizontal direction and M elements arranged in the vertical direction, where N is greater than M. Wiring to the anodes and/or cathodes is inclined in the horizontal direction such that long wiring distances are minimized, thereby minimizing wiring resistance and electrostatic capacitance.

Shino relates to a method for driving a plasma display device in which a sustained discharge current passes through a plasma cell including a rare gas such as neon or argon. The sustained discharge current excites the rare gas within the plasma cell, thereby causing the plasma cell to illuminate. In Shino, techniques are disclosed for obtaining improved luminance and illumination efficiency with smaller discharge currents.

Kawanami relates to a plasma display panel including base plates forming plasma cells therebetween. As in Shino, the plasma cells illuminate when a current passes through the plasma cell. Kawanami discloses a plasma display panel having an electrode that offers improvements in efficiency of luminescence and sustained discharge current.

Applicant's invention, as recited in claim 1, includes features neither disclosed nor suggested by the art of record, namely:

> an anode control circuit connected between said anode wires and said current source, for discharging said stored charge from said EL elements, and for controlling respective current flow into said anode wires,
>
> a cathode control circuit connected between said cathode wires and said voltage source, for discharging said stored charge from said EL elements, and for controlling respective voltages at said cathode wires,
>
> a display controller for controlling said anode control circuit and said cathode control circuit, said display controller including a setting unit for setting a discharge time for discharging said stored charge of said EL elements before light emission of said EL elements to a time Rt,
>
> wherein a discharge time Tx for discharging said stored charge before light emission of said EL elements is determined so as to obtain a luminance Lp of said EL elements determined by:
>
> $Lp \geq 0.9 \times Le$,
>
> where Le is a luminance of light emitted by said EL elements storing substantially no electrical charge, and said discharge time Rt satisfies the relation of:
>
> $Tx \leq Rt$.

This means that the EL elements are discharged during a set discharge time prior to driving them to emit light, which results in improved luminance. The discharge time is set such that light is not emitted from the EL elements until a sufficient discharge time has passed to allow the EL elements, when driven, to obtain a luminance of at least 90% or greater than the luminance achievable when no electric charge is stored in the EL elements. This feature is found in the originally filed application at page 7, line 2 through page 8, line 2.

The art of record is devoid of any teaching or suggestion of control circuits for controlling the discharge time of an EL element prior to emitting light from the EL elements, let alone

setting the discharge time such that the EL elements are allowed to discharge for a period of time needed to obtain a luminance of 90% or greater than the luminance obtained with no stored charge in the EL elements. As stated by the Examiner, Iwasa does not teach a mechanism for discharging the stored charge from EL elements. The Examiner relies on Shino and Kawanami to teach discharging of the EL elements. Shino and Kawanami, however, do not teach or suggest controlling the discharge time of an EL element prior to emitting light from the EL elements such that the EL elements are allowed to discharge for a period of time needed to obtain a luminance of 90% or greater than the luminance obtained with no stored charge in the EL elements as set forth in claim 1.

Referring to the abstract of Shino, the examiner states that Shino teaches "induction of main discharge between anodes and cathodes that is done through the discharging of the writing charge stored in the dielectric layer." The writing charge referred to in the abstract is discharged to accumulate a positive charge on the face of a dielectric layer. A DC negative sustaining voltage is then independently applied to a cathode to causes the accumulated charge to discharge toward the cathode and induce sustained discharge current flow from the anode to the cathode, thereby causing illumination of the light emitting element. See column 11, line 51 through column 12, line 56. The discharge of the accumulated charge induces the sustained discharge, however, a discharge time is not set for discharging the accumulated charge of the light emitting elements before light emission of the light emitting elements.

The examiner refers to two primary areas of the specification in reaching the conclusion that Shino teaches setting a discharge time for discharging accumulated charge of light emitting elements before light emission of the light emitting elements. First, referring to FIG. 6, the examiner states that "Shino establishes the relation between the discharge current Id and luminance B as plotted by the curve B." The plotted discharge current Id, however, is not a discharge current for discharging the charge accumulated at the light emitting elements before light emission of the light emitting elements. Rather, the discharge current Id is a sustained discharge current that causes light emission from the light emitting elements. See column 10, lines 41 - 64 and column 12, lines 28-47 of the Shino patent. Further, the sustained discharge current Id results from the application of voltage supplied from a power source rather than discharge of accumulated charge. See column 12, lines 48-49 of Shino, "[w]hen application of voltage to all the cathode buses K1 - - - KN is stopped, the sustained discharge ceases"

(underline added). Since the discharge current Id in Shino occurs during the emission of light from the light emitting elements and is due to voltage supplied by a power source rather than the discharge of accumulated charge, FIG. 6 of Shino does not disclose, teach, or suggest setting a discharge time for discharging the accumulated charge of light emitting elements before light emission of the light emitting elements.

Second, referring to FIGs. 23(a) and 23(b), the examiner states that "Shino teaches the discharge time of different values with respect scanning and sustaining discharge current values." As explained above, the discharge current referred to here, and throughout the specification of Shino, refers to a discharge current for illumination of the light emitting elements resulting from a voltage supplied by a power source rather than the discharge of accumulated charge of light emitting elements before light emission of the light emitting elements. Thus, FIGs. 23(a) and 23(b) of Shino patent do not disclose, teach, or suggest setting a discharge time for discharging the accumulated charge of light emitting elements before light emission of the light emitting elements. Further, nowhere in Shino is this feature disclosed, taught, or suggested.

Accordingly, for the reasons discussed above, Shino does not disclose, teach, or suggest setting the discharge time for discharging the accumulated charge of light emitting elements before light emission of the light emitting elements as set forth in claim 1.

The Examiner states that Kawanami teaches the major time variation of the discharge current and manipulation of discharge current in terms of minimum and maximum discharge currents as shown in Figure 7(A) of Kawanami. The Examiner further states that Kawanami discloses improving efficiency of luminescence by making the time at which the maximum discharge current appears close to the time at which the maximum efficiency of luminance appears referencing column 8, lines 33-52 and figures 7(A) and 7(B). A careful reading of the sections pointed out by the Examiner and the accompanying figures disclose that Kawanami has no relationship to the determination of discharge time for discharging an EL element prior to light emission from the EL element as set forth in claim 1. As described above in reference to Shino, the discharge current described in Kawanami is a discharge current passing through a plasma element to illuminate the element. Figures 7(A) and 7(B) of Kawanami depict this discharge current as generated by two electrodes having different shapes. The figures contrast

discharge current and efficiency for the two different electrode shapes. The first electrode shape, designated by "I," depicts an output characteristic that has a greater discharge current than the output of the second electrode shape, designated by "II," but at the expense of lower efficiency. This is irrelevant to the determination of a discharge time for discharging an EL element prior to light emission of the EL element to obtain a luminance of 90% or greater than a luminance emitted by an EL element storing no electric charge. Thus, Kawanami does not disclose, teach, or suggest controlling the discharge time of EL elements before light emission of the EL elements to achieve a luminance of 90% or greater than the luminance achieved from an EL element having no charge as set forth in claim 1.

It is because Applicants include the feature of controlling a discharge time for discharging stored charge in an EL element before light emission of the EL element to achieve a luminance of 90% or greater than the luminance achieved from an EL element having no charge that the following advantages are achieved. By properly setting the discharge time, Rt, the electric charge accumulated in the EL element can be removed effectively. As a result, the driving efficiency is improved. Further, the conventional defect of an apparent lowering of the display luminance is also improved. Further still, the display device is higher in driving speed, superior in reliability, lower in price, and smaller in size (see page 7, line 21 -page 8, line 2).

Accordingly, for the reasons set forth above, claim 1 is patentable over the art of record.

Independent claims 5, 18, and 21 include features similar to those discussed above with reference to claim 1. Accordingly, claims 5, 18, and 21 are also patentable over the art of record for the reasons set forth above. Claims 2, 4, 6-15, 19, 20, and 22-30 include all the features of either claims 1, 5, 18, or 21 from which they depend, either directly or indirectly. Thus, claims 2, 4, 6-15, 19, 20, and 22-30 are also patentable over the art of record for the reasons set forth above.

In view of the arguments set forth above, the above identified application is in condition for allowance which action is respectfully requested.

Respectfully submitted,

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